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(54) Tobacco smoke filter.

(57) Filter system for tobacco smoke, comprising a filter element 2 consisting of fibrous or granular filter material (3) and whereby in the complete filter system at least one member of the group selected from biologically active dried yeast haemoglobin 4 and granulated stimulants such as dry coffee and microcapsules, containing an activating liquid medium is occurring.

Especially the biologically active dried yeast is applied causing the biologically active cells being at least partially decomposing and/or converting the components of the tobacco smoke in non-toxic compounds on account of their own internal metabolism.

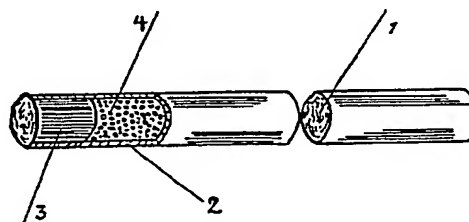


FIG.1

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Tobacco smoke filter.

The invention is relating to a tobacco smoke filter in the form of a filter element, consisting of fibrous or
5 granular filter material, whereby at least a part of the filter element is consisting of biologically active dried yeast, the biologically active cells of which are at least partially decomposing and/or converting the hydrocarbons of the tobacco smoke in non-toxic compounds, on account of their own
10 internal metabolism.

The harmfulness of tobacco smoke, which has become extensively known up to now has appeared not to be diminished to a sufficient level by means of adapted filter techniques.

References to reached filter activities are at
15 present legally prescribed and have to be indicated on the cigarette packings in several countries.

Up to now these prescribed indications are provisionally referring only to the tar and/or nicotine contents, although the tobacco smoke also contains dangerous amounts of
20 carbonmonoxide, nitrogen oxides, hydrogen sulfide and cyano compounds.

Efforts with the aim to filtrate the tobacco smoke more adequately are however restricted to certain limits.

For example the taste appraisal may be changed in a
25 negative way, while also the air flow through the cigarette by the smoking operation may be changed.

Both phenomena are irritating the smoker in the same way. These mentioned effects are especially occurring in the case that the operation of the filter of a conventional
30 filter is changed. If for instance the structure of a fibrous acetate filter is condensed although more condensate components may possibly be retained, the sucking of tobacco smoke becomes more difficult, however.

If on the contrary more hydrocarbons are absorbed
35 by means of a granular absorbing filter material then this will occur at the cost of the taste and enjoying of the smoking is weakened significantly.

This is also the case when paper-ventilated

cigarettes are used wherein the tobacco smoke is diluted giving rise to considerable taste-losses therefore.

It is an object of the present invention to avoid or to diminish the indicated disadvantages; hereby is aimed at
5 a special solution which is advantageous with reference to costs.

According to the present invention the faced problem is dissolved in that way that the conventional filter element is further applied, and also as well the fibrous filter
10 element in the cigarette as the filter capsule for cigarette tips and tobacco pipes, which are filled with a granular absorbing material. Fibrous filters like those that are presently applied in cigarettes may, for example, only be shortened in their length and the fibrous material, which is
15 lacking due to this shortening is replaced by biologically active dried yeast cells, which are inserted therefore in the wrapping of the filter tip of cigarettes and are occurring between shortened fibrous filters and the tobacco. In filter capsules or filter cartridges for cigarette tips and tobacco
20 pipes for instance, wherein granular absorbing filter material is present, the also granular biologically active yeast cells are only mixed, after the removal of a part of the conventional filter material.

The part of the mixture of biologically active
25 dried yeast in the respective filter elements are depending of the goal aimed at, the types of tobacco and the like, whereby the moisture content of the dried yeast is likewise adaptable.

An advantage of such a filter construction, wherein a part of the filter material is consisting of a biologically
30 active dried yeast is not only residing in this significant enlarging of the active filter surface (1 g of dried yeast provide 2 m²), but also in the fact that in 1 g of dried yeast there are about 10 milliard of biologically active cell organisms. By means of the natural metabolism of these yeast cells
35 the hydrocarbons in tobacco smoke are at least partially decomposed and or converted in non-toxic compounds, such as carbondioxide.

According to an alternative embodiment of the invention, there is proposed to wash the fibrous filter

material with biologically active dried yeast cells during the preparation or to impregnate the fibrous filter material.

The presence of certain yeast cultures may also be assumed to be possible during the soaking of the tobacco, when
5 pretreated.

Several types of filter element constructions, which may suitably be applied for the purpose of the present invention, are generally available and are known from e.g. the Dutch patent application no. 7307797, Belgian patents nos.
10 875.736, 807.245, 788.366, 760.404 and 773.615, British patents nos. 1.255.657 and 1.318.113 and Canadian patent no. 923.397.

The invention is illustrated by means of the embodiment, which is represented by the way of example by
15 figure 1. Figure 1 relates to a transverse section through the end of a cigarette with a filter according to the improvement of the present invention. This figure shows a part of a cigarette with tobacco filling (1) with connected filter tip (2), wherein shortened fibrous filter material (3) and the
20 fitted filter material (4), consisting of biologically active dried yeast between the fibrous filter part and the tobacco filling, is occurring.

As specific example of a biologically active dry yeast, yeast preparations derived from Sacharomyces cerevisiae
25 may be applied, however, also other yeasts belonging to the genus Torulopsis or to other species of Saccharomyces, such as Saccharomyces carlbergensis, Saccharomyces beticus, Saccharomyces rosei, Saccharomyces cheresiensis, Saccharomyces fermenti and Saccharomyces pasteurianus may be applied with
30 good results.

It will be appreciated that preferably biologically active dried yeast is applied, which is regularly available in commercial, i.e. unlimited, amounts against a relatively low cost price pro unity, like e.g. dry yeast derived from
35 Sacharomyces cerevisiae, and which shows a sufficient large internal active surface.

The genetic character or the disposition of the yeast cells may be possibly further adapted by suitably selected propagation methods to meet the desired conditions.

The preferably applied biologically active dried yeast may be prepared from fresh compressed yeast by a process as disclosed in e.g. the British patent no. 1.230.205, relating to the preparation of dry yeast using preferably a fluidized drying equipment and starting from compressed yeast having a high biological activity.

The biologically active dry yeast can be added in an amount of 0.01-0.5 g pro gram of tobacco and preferably in an amount of 0.1-0.2 g pro gram of tobacco.

10 It is true that incorporation to dried yeast to cigarette filters is known from the French patent no. 2.151.814 and from the US patent no. 4.121.599.

In the French patent no. 2.151.814, cotton is soaked in a milk solution containing green kaolin and a minor
15 amount of powdered yeast and thereafter dried, cut and rolled into the form of a cigarette filter.

However, there has been no appreciation in this patent that improved filters might be obtained using as the filter media yeast or fungal mycelia when in particulate form.

20 Furthermore, there has been no recognition of the filtration efficiency of such filters, particularly in relation to the selective removal of particulate matter from gaseous streams such as tobacco smoke, and nowhere in this patent there may be found any suggestion or indication that
25 such selective removal of specific matter from tobacco smoke may be reached with attractive results by using biologically active dry yeast.

In the US patent no. 4,121,599 is disclosed a tobacco smoke filter including a particulate medium obtained
30 from fungal mycelia and/or yeast. The filter preferably has a cylindrical paper wrapper, while the medium is from the classes Phycomycetes, Ascomycetes, Fungi Imperfecti and Basidiomycetes, having an average particle size of 125-3300 and being agglomerated with carboxymethylcellulose, glycerol
35 methyl cellulose or corn syrup binder.

Especially in example II (column 4) of this patent, the application of baker's yeast has been indicated, but it will be appreciated that only much less biologically active or inactive dried yeast could be used. It will be appreciated,

that the attractive results reached by using filtersystems of the present invention, i.e. the selective removal of specific tobacco smoke components as compared with those obtained with filter systems according to the beforementioned patents could in no way be predicted or expected by people skilled in the art on account of the subject matter of these patents, by which is particularly not suggested or thought in any way that the metabolism in a biologically active dried yeast can be activated.

10 An additional feature of the present invention is relating to an improved tobacco smoke filter, containing at least an amount of the blood pigment "haemoglobin" in a part of the filter element.

 This addition of haemoglobin to the filter element
15 was found to improve the elimination of carbon monoxide to a higher degree.

 The haemoglobin is preferably added in an oxidized state and in the form of a dry, colourless preparation, in powder form, which may be obtained according to a process,
20 comprising oxidation of dry haemoglobin by means of oxygen providing compounds, followed by washing of the oxidation product with water and subsequent drying.

 The dry haemoglobin starting material may be prepared from animal blood sources by methods known in the
25 art.

 Preferably the oxidation of haemoglobin is carried out with hydrogenperoxide, several per compounds or ozone. The oxygen providing agents are used in a concentration between 10 and 30% by weight depending on the specific state of dry
30 haemoglobin starting material, the per compounds or ozone to be used.

 It was found, due to the application of non oxidized haemoglobin preparations, that the content of the harmful carbonmonoxide and several nitrogen oxides in the
35 tobacco smoke gas may be additionally lowered, while application of oxidized colourless haemoglobin preparations gives rise to lowering of the content of nitrogen oxides and hydrogen cyanide.

 The haemoglobin preparation to be applied according

to a preferred embodiment may be accommodated in one or more of the compartments formed by hollowing out a fibrous filter, according to several construction types as known from the literature beforementioned.

5 More specifically in filter capsules or cartridges for cigarette pipes and tobacco pipes, for instance, the haemoglobin preferably may be mixed with already available filter materials and more particularly biologically active dried yeast as co-ingredient. Preferably the haemoglobin and
10 this dried yeast are applied in a range of weight ratios from 1:2 to 2:1 and more preferably in a weight ratio of about 1:1.

According to another embodiment, the filter materials for cigarettes may be impregnated with haemoglobin or
15 the haemoglobin may be granulated.

Another alternative for carrying out this application of haemoglobin in cigarette filters might be the building in of haemoglobin during the cell formation of biologically active dried yeast cells during or after the cultivation, in
20 cases that biologically active dried yeast is simultaneously incorporated in the filter element and which alternative may be advantageous, having in mind that the filtering action of yeast cells as to nicotine could be detected.

According to another feature of the present invention, also dry granulated stimulants and more particularly
25 caffeine containing dry coffee, may be included in the filter to improve and/or intensify the taste quality and the flavour of the tobacco smoke, while simultaneously adsorption or binding of harmful compounds is maintained.

30 In this connection it has to be pointed out, that world wide research have shown, that the keen smoker puts the enjoy of smoking in the forefront unconditionally. Actually it seems to be the rite, which is connected with the smoking of tobacco and which is decided by enjoyment and is culminating
35 in the combination of nicotine and caffeine by a large number of smokers.

Preferably such stimulants may be included in the filters of the present invention, by methods known per se and by means of known constructions as indicated hereinbefore. For

examples this inclusion may be carried out by shortening the cigarette filter or diminishing the amount of the absorbing filter materials, occurring in other filter devices - such as those occurring with tobacco pipes and cigarette pipes - so
5 that an empty room is created in filter cigarettes or in other filter systems due to a diminished volume of filling with filter material.

It will be appreciated that the stimulants such as dry coffee may be mixed up, before incorporation in the
10 filtersystem, with suitable additional filter aids like e.g. biologically active dried yeast, biologically active or soluble milk powder, or with other flavouring agents, which preferably are readily soluble, like e.g. medicinal-pharmaceutical agents.

15 An additional more preferred embodiment of the invention has been based on the findings, that the proposed biologically active dried yeast, in corporation in the filter element, could be activated more effectively. According to the conventional conception of people skilled in the art, there
20 was initially presumed that the absolute humidity in the tobacco of e.g. a cigarette possibly could initiate an autolysis of the yeast during prolonged storage times.

However, it was surprisingly found that when the biologically active dry yeast is arranged in a separate filter
25 room - i.e. separated from the tobacco strand - the activation of the dry yeast started very slowly during smoking. However, when the amount of dry matter was decreased, a sudden activity started at 92% of dry matter and for example during smoking of a cigarette the CO-amount was found to decrease from 17.0 ppm
30 to 9.0 ppm, indicating that an efficient activation of the biologically active dried yeast in the filter element of a cigarette can be started e.g. immediately before smoking, without changing the amount of the dry matter of the yeast on beforehand.

35 According to a preferred embodiment of the present invention, this problem was solved by mixing the filter-substance, containing the biologically active dry yeast, with a matching amount of microcapsules, containing a liquid medium.

Hence, according to one specific embodiment it was proposed to arrange biologically active dried yeast with an added and matching amount of microcapsules in a filter element in such a way, that at least a part of the filter element
5 consists of biologically active dried yeast, together with microcapsules.

These microcapsules are suitably filled with water or a sugar solution of a low concentration, and which burst open during the inhalation of tobacco smoke through the
10 filter. In this way the liquid suddenly will activate the biologically active dried yeast, due to the preferred nutrient supply.

The bursting of the microcapsules may be reached on the one hand by means of osmotic adaptation in the filter
15 element by sucking on the tobacco smoke or on the other hand by means of a slight finger press on the filter element before smoking a cigarette.

These microcapsules are known on their own and may be prepared e.g. according to methods disclosed in US patents
20 nos. 3.494.505, 3.503.783, 3.516.846, 4.201.404 and 4.225.460, British patents nos. 2.021.512 and 1.370.282 and Dutch patent no. 135.125. However, the presently proposed use of such microcapsules is nowhere disclosed or even suggested.

It will be appreciated, that the filter components
25 may be arranged in successive compartments of a filter element.

According to another feature of the present invention the microcapsules, containing a suitable liquid medium, may also be incorporated in the filter element as
30 such, in order to achieve a cooling of the smoke gasses and/or humidification of the tobacco.

It will be appreciated, the hereinbefore described microcapsules also may be filled with other liquids and compounds, which are subservient to the filtering and/or flavou-
35 ring of tobacco smoke. They can also constitute an independent filter element.

By the way of example a specific preferred embodiment of the present invention may be illustrated by means of the figure (2), showing a transverse section of a cigarette

with tobacco filling (1) and connected filter tip (2), wherein a shortened, fibrous filter material (3) and the arranged biologically active dried yeast as filtering agent (4) with the included microcapsules (5).

5

The invention may be illustrated by the following example, however, without any limitation of the scope of the invention to the described embodiments, but only by the lawful scope of the appended claims.

10

Example

Smoking experiments were carried out, under DIN standard conditions and using DIN G-80 apparatus, with 15 cigarettes, the filter of which was composed in different ways according to the details indicated below:

cigarette A = a Peter Stuyvesant® cigarette with a normal filter construction, without any addition.

20

cigarette B = the same cigarette, with biologically active yeast, which was previously brought on the humidity of the tobacco. (dry matter content 94%), incorporated in the filter, in a total amount of 0.2 g.

25

cigarette C = the same cigarette, but with biologically active yeast and haemoglobin in equal amounts and in a total amount of 0.2 g.

30

cigarette D = the same cigarette, containing biologically active yeast and oxidized haemoglobin in equal amounts and in a total amount of 0.2 g.

Cigarette	A	B	C	D
cig. length	62 mm	63 mm	62 mm	63 mm
cig. diameter	7.93mm	8.0 mm	8.0 mm	8.0 mm
5 filter length	21 mm	21 mm	21 mm	20 mm
filter diameter	7.95mm	7.85mm	7.85mm	8.0 mm
empty weight	164 mg	180 mg	181 mg	182 mg
retention con- densate of filter	44.0 %	48.1 %	46.0 %	47.0 %
10 smoking gas	CO : 13.2 mg	11.8 mg	9.2 mg	9.6 mg
contents analysis	CO ₂ : 35.5 mg	34.4 mg	38.2 mg	37.3 mg
	HCN: 100 ppm	100 ppm	40 ppm	40 ppm
	NO/NO ₂ : 40 ppm	5 ppm	5 ppm	5 ppm

1. Filter system for tobacco smoke comprising a filter element, consisting of fibrous or granular filter material, whereby at least a part of the filter element is formed by biologically active dried yeast.

2. Filter system for tobacco smoke comprising a filter element, consisting of fibrous or granular filter material, whereby at least a part of the filter element is formed by haemoglobin.

3. Filter system for tobacco smoke comprising a filter element, consisting of fibrous or granular filter material, whereby at least a part of the filter element is formed by granulated stimulants.

4. Filter system for tobacco smoke comprising a filter element, consisting of fibrous or granular filter material, whereby at least a part of the filter element is formed by microcapsules, containing a liquid medium.

5. Filter system according to claim 1, characterized in that in addition to the biologically active dried yeast a matching amount of microcapsules, containing an activating liquid medium, is occurring.

6. Filter system according to claim 4, characterized in that as activating liquid water or an aqueous sugar solution of low concentration is used.

7. Filter system according to claim 2, characterized in that colourless, oxidized haemoglobin is used.

8. Filter system according to claim 1, characterized in that the biologically active dried yeast is occurring in an amount of 0.01 - 0.5 and preferably of 0.1 - 0.2 g. pro gram of tobacco.

9. Filter system according to claim 1, characterized in that the fibrous filter material is processed in the presence of or is impregnated by biologically active dried yeast.

10. Filter system according to claim 2, characterized in that the fibrous filter material is impregnated by haemoglobin.

11. Filter system according to claim 2, characteri-

zed in that the haemoglobin constitutes an independent filter element.

12. Filter system according to claims 1 and 2, characterized in that haemoglobin is incorporated together with 5 biologically active dried yeast.

13. Filter element according to claim 12, characterized in that the weight ratio between haemoglobin and biologically active dried yeast varies between 1:2 and 2:1.

14. Filter element according to claim 13, 10 characterized in that haemoglobin and yeast is incorporated in an amount of 0.1 - 0.2 g. pro gram of tobacco.

15. Filter system according to claims 1 and 2, characterized in that the haemoglobin is incorporated in biologically active dried yeast.

16. Filter system according to claim 4, characterized in that the microcapsules are containing flavouring agents.

17. Filter system according to claim 3, characterized in that the stimulant is a caffeine containing 20 dry coffee.

18. Filter system according to claim 1-4, characterized in that it is at least containing biologically active dried yeast, colourless oxidized haemoglobin, caffeine containing dry coffee and microcapsules containing water or an 25 aqueous sugar solution.

19. Premix for the preparation of filter elements for the filtering of tobacco smoke, containing one or more ingredients selected from a group consisting of biologically active dried yeast, colourless oxidized haemoglobin, caffeine 30 containing containing dry coffee and microcapsules containing water or an aqueous sugar solution.

20. Formed filter element, containing anyhow one or more of the ingredients according to claims 1-18, incorporated over two or more separate chambers.

21. Filter cigarette, containing a formed filter element according to claim 20. 35

22. Process for the selective purification of tobacco smoke comprising the use of a filter system according to any one of the claims 1-18.

Claims for Austria

1. Process for the preparation of a filter system for tobacco smoke, comprising a filter element, consisting of
5 fibrous or granular filter material, characterized in that at least a part of the filter element is formed by biologically active dried yeast.

2. Process for the preparation of a filter system for tobacco smoke, comprising a filter element, consisting of
10 fibrous or granular filter material, characterized in that at least a part of the filter element is formed by haemoglobin.

3. Process for the preparation of a filter system for tobacco smoke, comprising a filter element, consisting of fibrous or granular filter material, characterized in that at
15 least a part of the filter element is formed by granulated stimulants.

4. Process for the preparation of a filter system for tobacco smoke, comprising a filter element consisting of a fibrous or granular filter material, characterized in that at
20 least a part of the filter element is formed by microcapsules containing a liquid medium.

5. Process according to claim 1, characterized in that in addition to the biologically active dried yeast a matching amount of microcapsules, containing an activating
25 liquid medium, is incorporated.

6. Process according to claim 5, characterized in that as activating liquid water or an aqueous sugar solution of low concentration is used.

7. Process according to claim 2, characterized in
30 that an colourless oxidezed haemoglobin is used.

8. Process according to claim 1, characterized in that the biologically active dried yeast is occurring in an amount of 0.01-0.5 and preferably of 0.1-0.2 g. pro gram of tobacco.

35 9. Process according to claim 1, characterized in that the fibrous filter material is processed in the presence or is impregnated by biologically active dried yeast.

10. Process according to claim 2, characterized in

that the fibrous filter material is impregnated by haemoglobin.

11. Process according to claim 2, characterized in that the haemoglobin constitutes an independent filter element.

12. Process according to the claims 1 and 2, characterized in that the haemoglobin is incorporated together with biologically active dried yeast.

13. Process according to claim 12, characterized in that the weight ratio between haemoglobin and biologically active dried yeast varies between 1:2 and 2:1.

14. Process according to claim 13, characterized in that haemoglobin and yeast incorporate in an amount of 0.1-0.2 g. pro gram of tobacco.

15. Process according to the claims 1 and 2, characterized in that the haemoglobin is incorporated in biologically active dried yeast.

16. Process according to claim 5, characterized in that the microcapsules are containing flavouring agents.

17. Process according to claim 3, characterized in that the stimulant is a coffein containing dry coffee.

18. Process according to the claims 1 to 5, characterized in that it is at least containing biologically active dried yeast, colourless oxidized haemoglobin, coffein containing dry coffee and microcapsules containing water or an aqueous sugar solution.

19. Process for the preparation of a premix for application in filter elements for the filtering of tobacco smoke, characterized in that the premix is containing one or more ingredients selected from a group consisting of biologically active dried yeast, colourless oxidized haemoglobin, coffein containing dry coffee and microcapsules, containing water or an aqueous sugar solution.

20. Process for the selective purification of tobacco smoke comprising the use of a filter system obtained according to any one of the claims 1 to 18.

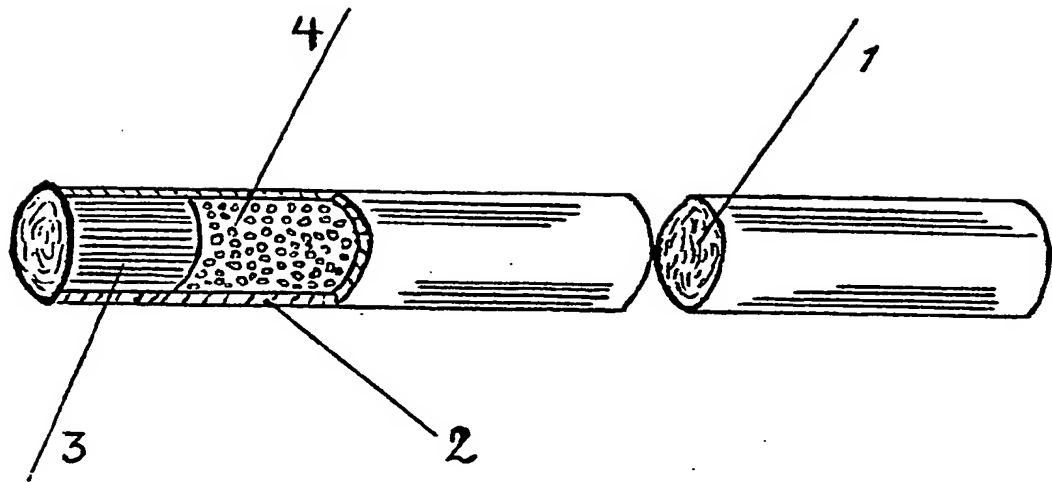


FIG.1

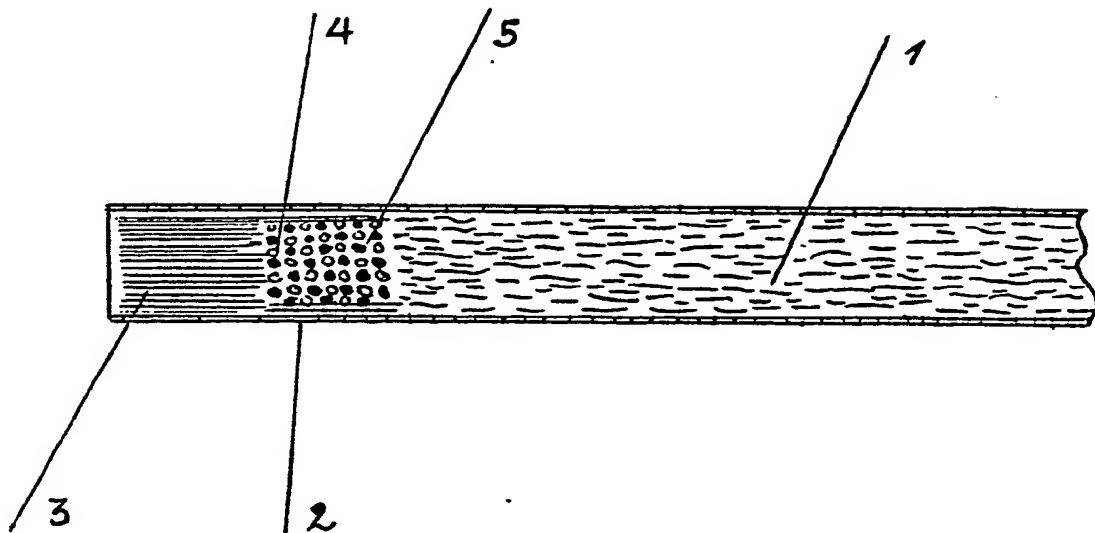


FIG.2



European Patent
Office

EUROPEAN SEARCH REPORT

0058463

Application number

EP 82 20 0202

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>US - A - 3 319 630</u> (N.B. ORRMINS) * claim 1 * ---	3,17	A 24 D 3/14
A	<u>US - A - 4 049 673</u> (I.H. SCHEINBERG) * claim 1; column 4, lines 10-14 * ---	2	
A	<u>CH - A - 461 335</u> (AMERICAN TOBACCO CO.). * claim; sub-claim 1; column 4, line 5 * ---	4,6,16	TECHNICAL FIELDS SEARCHED (Int. Cl. 3) A 24 D A 24 C
D,A	<u>US - A - 4 121 599</u> (R.P. NEWTON et al.) * claim 1; column 4, line 46 * -----	1	
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons
			&: member of the same patent family, corresponding document
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 15-04-1982	Examiner ALMOND